Bristol® ControlWave® PAC

Process Automation Controller

Bristol® ControlWave® PAC, from Emerson Process Management, is a highly adaptable, high performance Process Automation Controller with exceptional networking capability to provide a complete Process Automation Management Solution. Designed with a great emphasis on scalability and modularity, ControlWave can be configured to maximize the performance of a wide range of control systems, from small or mid-size applications to large ones. Additionally, due to its small form factor and rugged industrial design, ControlWave offers an outstanding ability to match the requirements of the most demanding process plant and SCADA system environments. Above all, Emerson has developed this innovative controller to provide cost-effective solutions by minimizing the time required for installation and configuration.

Through this new open architecture, ControlWave provides an ideal hybrid union of PLC, RTU and DCS without compromising the unique features and capabilities of each product. Consequently, the ControlWave Process Automation Controller not only introduces the great possibilities of an open architecture for emerging communication standards, but it also provides a simple solution for existing networks. From its conception, ControlWave was intended as a very flexible system capable of satisfying the requirements of local, expanded, remote and distributed I/O combinations. It is widely accepted as a scalable platform because it can be used for small applications using a single rack, but it can also be expanded to large applications spanning an entire plant.



Hardware Features

- 586 based processor provides unparalleled performance
- Up to three 100/10 MB Ethernet ports
- Ethernet remote I/O
- Up to four serial communication ports
- 2, 4, and 8 I/O slot panel mount chassis, panel or 19” rack mount on 8 slot chassis
- Single and double density I/O modules
- Hot Swap I/O replacement
- Security key-lock to prevent unauthorized access
- Internal loop power for I/O simplifies installation
- AOs maintain last/preset value on CPU Watchdog
- DOs maintain last or zero value on CPU Watchdog
- Wide temperature range (-40 to +70ºC)
- Class I, Div. 2 hazardous location and CE approval
- Open, industry standards for programming, configuration and communication

Scalability

ControlWave PAC meets the needs of a wide range of applications, from a unit controller RTU to a powerful plant process control system through its modular architecture, large I/O capacity and Ethernet networking capability.

For smaller I/O configurations, the low power ControlWave Micro and Express are ideal RTU packages with all of the same software capabilities of their ControlWave PAC big brother.

ControlWave Micro is a compact modular RTU/PLC hybrid, providing up to eleven serial communication ports and optional built-in 100/10 Base-T Ethernet ports. Built-in spread spectrum radio and dial-line modem options reduce integration cost, enhance communication flexibility and provide communication back-up.

The base unit is used to house the power system, CPU and 2 or 6 I/O modules. The base is expandable up to fourteen I/O slots through 2,4 or 8 slot plug-on I/O expansion bases.

ControlWave Express is a very compact, low profile SCADA RTU with a fixed I/O point count. Extremely low power consumption makes ControlWave Express highly suitable for many remote sites common in water, wastewater, and natural gas applications

Open Standards for Programming, Network Configuration and Communication

Only ControlWave brings the perfect combination of industry standards to minimize learning, engineering and implementation costs.

By adhering to such industry standards as Ethernet, TCP/IP, Microsoft Windows, COM/DCOM, FTP, OLE and ActiveX, ControlWave is able to achieve the highest degree of openness in control system architecture and bring the optimal process efficiency and productivity needed to ensure a successful system implementation.

ControlWave Designer with ACCOL III

To minimize your engineering and development time, we have adopted the international standard for PLC programming, IEC 61131-3. ControlWave Designer is a fully IEC 61131-3 compliant programming environment for the ControlWave family of products. ControlWave Designer includes all five IEC 61131-3 process languages for batch, continuous and discrete control: Function Block Diagram, Structured Text, Sequential Function Chart, Ladder Logic Diagram and Instruction List.

ControlWave Designer includes an extensive library of more than 200 basic IEC 61131-3 functions and function blocks common to many IEC 61131-3 based products. These include:

- Flip-flops, Counters & Timers
- Ladder diagram functions - coils and contacts, etc.
- Numerical, Arithmetic & Boolean functions - Sine, Cosine, Add, Sub, Square Root, And, Or, etc.
- Selection & Comparison - Min, Max, Greater than, Equal, Less than, etc.
- Type conversions - Integer to Real, Boolean to Word, etc.

ACCOL III

In addition to the basic functions and function blocks, ControlWave Designer brings the benefit of over twenty years of SCADA and plant control experience in Emerson's Bristol ACCOL III function block library. ACCOL III includes over sixty function blocks valuable for use in oil & gas, water and wastewater and process measurement & control applications. Further, ACCOL III is designed to take full advantage of the significant features offered by ControlWave.

Briefly, this library includes function blocks for:

- Average, Compare, Totalize
- Scheduling & Sequencing

- PID & Lead/Lag
- AGA gas flow and liquids calculations
- File handling

In addition, ControlWave ensures data integrity, in the event of a communication interruption, by storing critical time-stamped alarm and historical data in the controller memory. This data is then securely retrieved when communication is restored.

Specifications

CPU

- AMD Elan 520 processor: 586 CPU-100 Mhz
- Data Memory: 2 MB SRAM battery backed memory
- Historical Archive memory: Stored in either flash or battery backed SRAM
- Code/ Instruction Memory: 16 MB on-board Flash
- Synchronous Dynamic memory: 4 MB (66MHz SDRAM coupled to a 32-bit bus)
- PCI bus for communication expansion module
- 2-digit 'Port 80' display for booting and run-time diagnostics
- Key-lock security switch

Communication

- Two RS-232 serial communication ports with standard PC/AT 9-pin male D-sub connectors on CPU module, both supporting baud rates up to 115.2 KB
- Two expansion RS 232 or RS 485 serial communication ports: up to 115.2 KB

  1 standard PC/AT 9-pin D-sub Connector and 1 RJ45 8-pin connector
- Isolation: RS 485 serial communication ports isolated to 500 Vdc
- Up to three independent 100/10 Base-T Ethernet ports with RJ45 connectors
- Isolation: Ethernet ports isolated to 500 Vdc

Power Supply and Chassis

- 12 or 24 Vdc power
- Power-fail detection and recovery sequencer
- System LEDs for: Active , Fail, & Power OK
- Power supply isolation: 500 Vdc
- ISA bus for I/O system (supports Hot Swap I/O) able to drive 8 local chassis I/O modules
- 2 – I/O slot chassis: Panel Mount 7.97"W x 6.97"H x 4.96"D (202.43W x177.03H x 125.98D)
- 4 – I/O slot chassis: Panel Mount 11.84"W x 6.97"H x 4.96"D (300.73W x 177.03H x 125.98D)
- 8 – I/O slot chassis: Panel Mount or 19" Rack Mount 18.96"W x 6.97"H x 4.96"D (481.58W x 177.03H x 125.98D)

Environmental Specifications

- Industrial operational temperature limits (-40 to + 70°C)
- Humidity: 0-95% (non-condensing)
- Vibration limits: 1.0 g acceleration over 10-150 Hz; 0.5 g acceleration over 150-2000 Hz

ControlWave Local I/O

ControlWave 'Process Friendly' local I/O modules are designed to maximize usability while minimizing installation, maintenance, and system downtime costs. A pull-down door provides front panel wiring terminal access for technicians. The bezel and even the terminations can be easily removed from the I/O card to make wiring even easier. In addition, the availability of both local direct and remote DIN rail terminations conveniently accommodates a wide range of applications.

To minimize field wiring and eliminate the need for marshalling strips, the analog input and digital input modules are capable of supplying loop power to two

wire transmitters and dry contacts. For maximum channel-to-channel isolation, externally powered analog and digital inputs may be selected.

Status-at-a-glance indicators offer instant visual notification of I/O system problems. Each I/O module has a bi-color Pass/Fail LED to display the on-line diagnostic status. Digital I/O status LED's are provided for each point. Analog Input modules have a unique feature. Each input point has two LEDs to indicate input under/over range conditions due to open and shorted field devices. The green LED, when lit, indicates the input is in a normal range. The Red LED, when lit, indicates the input is under or over range, typically meaning it is open or shorted.

Features

- Convenient 'Process Friendly' pluggable local and remote wiring terminations simplify installation
- Status-at-a-glance LED indicators
- Single and Double density I/O count available for all modules provide application flexibility
- Loop powered inputs minimize wiring costs
- Easy access pull-down door with terminal wiring labels
- Hot Swap I/O replacement
- All I/O modules are enclosed in a rugged aluminum shell
- Analog outputs configurable for 'Hold last value, Fail-Safe state or preset value'
- Discrete outputs configurable 'Hold last value or fail to zero'



Specifications

All I/O

- Surge protection meets C37.90-1978 and IEC 801-5
- Terminations are pluggable and accept a maximum wire size of 14 gauge
- 'HOT SWAP' module replacement is supported. All I/O is frozen for 300 ms when any module is replaced
- Environmental Specifications

  Operating Temperature range: -40 to 70°C (-40 to 158°F), storage up to 85°C

  Relative Humidity: 15-95% non-condensing

  Vibration: 1.0g for 10-150 Hz, 0.5g for 150Hz to 2000Hz

  RFI Susceptibility: 3V/m – 80 MHz to 1000Mhz (EN50082-2)

ControlWave Digital Input Module

- Number of points: 16 or 32 – non-interrupting inputs
- 16-bit wide bus access
- Input Voltage Range: 24 Vdc nominal
- Input current : 5 mA nominal
- Optical isolation: 1500 V field input to logic
- Surge suppression: 500Vdc MOV to chassis 31 Vdc transorb between signal and isolated ground
- Input filtering: 30 ms time constant (contact bounce)
- Dry contact or externally powered voltage inputs – 21 Vdc on-board isolated loop power

supply for contacts

- Power Consumption: 100 mA max @5V (all LED's on)
- Status indication: LED per point status and module OK/FAIL LED

ControlWave Digital Output Module

- Number of points: 16 or 32
- 16-bit wide bus access
- Output type: solid state open source MOSFET
- Operating voltage range: 10 - 31Vdc
- Maximum operating frequency: 20 Hz
- Current sink load capability: 500 mA at 31V
- Electrical isolation: 1500 Vdc
- Surge supression: 500 MOV to chassis

  31 Vdc transob between signal and isolated ground
- Status indicator: LED per point status and module OK/FAIL LED
- Configurable Fail State 'OFF', or 'Hold Last Value'
- Power consumption: 143 mA max @ 5 Vdc (all LEDs ON)

ControlWave Analog Input Module

- Number of Channels: 8 or 16
- A/D Resolution: 14 bit
- Input Configuration: Isolated voltage input: 500 V per card to chassis 31 V per channel when externally sourced
  - Internally or externally sourced current Input:Single-ended inputs 4-20 mA
  - Voltage Input: Isolated Differential inputs 1-5 V dc
  - Externally sourced current loop with 1–5 V input module and 250 ohm resistor across the input terminals or 4-20 mA input module
- Input Impedance: > 1 megOhm for 1-5 Vdc, 250 Ohm for 4-20 mA
- Common Mode Rejection: 70 db
- Normal Mode Rejection: 26 db
- Input Filtering: 300 ms to 99.9% of input signal
- Channel Settling Time: 680 microseconds
- Conversion Time: 25 microseconds
- Accuracy:
  0.1% of span 25°C
  0.2% of span -20 °C to 70 °C
  0.3% of span -40 °C to 70 °C
- Isolated Voltage Common Mode Range: 31 Vdc to isolated common
- LED Indicators : Normal, Over-range/Under-range, module FAIL/OK
- On board References: 1V, 5V
- On-board isolated loop supply for internally powered AI
- Surge Supression: 31 Vdc transorb across input signals and (-) input to chassis
- 500Vdc MOV isolated common to chassis

Thermocouple Input Module

- Number of Channels: 6 AI
- Input type: B, R, S, J, E, K, T, C, N, +/- 10 mV
- AI Resolution: 16 bit
- Input Configuration: Differential thermocouple
- Voltage input Impedance: 10 megΩ
- Channel data acquisition: 50 microsec
- Conversion Time: 66 millisec for all 6 inputs
- Input Accuracy: Varies by thermocouple type

  0.025% of span at 25°C for 10 mV input

  0.95% of span -25°C to 70°C for 10 mV input
- Common Mode Rejection: 120 db

- Normal Mode Rejection: 80 db
- Electrical Isolation: 500 Vdc channel to channel and channel to bus
- Surge Suppression: 180 Vdc transorb between signal and ground meets IEEE 472.1978
- Cold Junction Compensation: RTD sensor on terminal block
- Local or remote terminations
- Power Consumption - 6 inputs:

  TC analog input: 0.96 watt

RTD Input Module

- Number of Channels: 4 AI
- Input Type; 2, 3, or 4 wire RTD
- AI Resolution: 16 bit
- Voltage Input Impedance: 9.6 KΩ
- Channel Data Acquisition: 50 microsec
- Conversion Time: 3 wire - 266 ms, 4 wire - 200 ms, for all 4 inputs
- Input Accuracy:

  +/- 0.5°C at 25°C

  +/- 1.0°C at -40°C to 70°C
- Common Mode Rejection: 120 db
- Normal Mode Rejection: 80 db
- Electrical Isolation: 500 Vdc channel to channel and channel to bus
- Surge Suppression: 12 Vdc transorb between signal and ground meets IEEE 472.1978
- Local or remote terminations
- Power Consumption - 4 inputs:

  RTD analog input: 0.6 watt

ControlWave Analog Output Module

- Number of Channels: 4 or 8
- Output configurations: 4-20 mA (650 max. drive)
- D/A resolution: 12 bit
- Accuracy:
  0.1% of span @ 25°C for current output
  0.2% of span @ -20 to 70°C for current output
  0.3% of span @ -40 to 70°C for current output
- Electrical Isolation from the power system by an opto-coupler and a dc/dc converter.
- Settling time: 1 ms
- FAIL and OK module status LED
- Surge Supression: 31 Vdc transorb across output signals and (-) output to common
- Power Consumption: 91 mA max. @5 V (all LEDs ON)
- 500Vdc MOV isolated common to chassis
- Configurable Output Fail State (hold last value, zero (-5%), to specified value)

ControlWave Universal Digital Input Module and Counter (UDI)

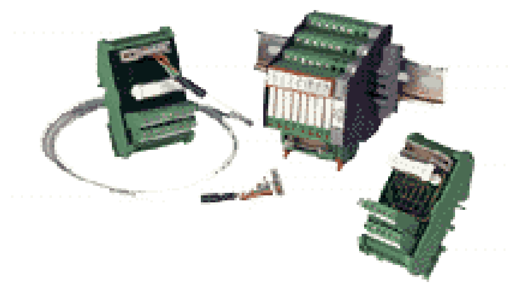
- Number of points: 6 or 12
- Polled DI and High Speed Counter or Low Speed Counter
- Bus Access: 16-bits wide
- Frequency Range: 0-10 KHz
- Input Voltage Range: 12V, 24V
- Debounce circuitry factory set Enabled or Disabled
- Input Current: 5mA +/- 10%
- Each counter input can be configured as a polled input, Low Speed Counter, or High Speed Counter (Roll-over on 65536, not software resettable)
- Input Filtering, Software configurable for:
  20 micro seconds for high speed counter
  1 milliseconds for low speed counter 30 milliseconds for contact closure interruptible DI
- Loop power for dry contact inputs

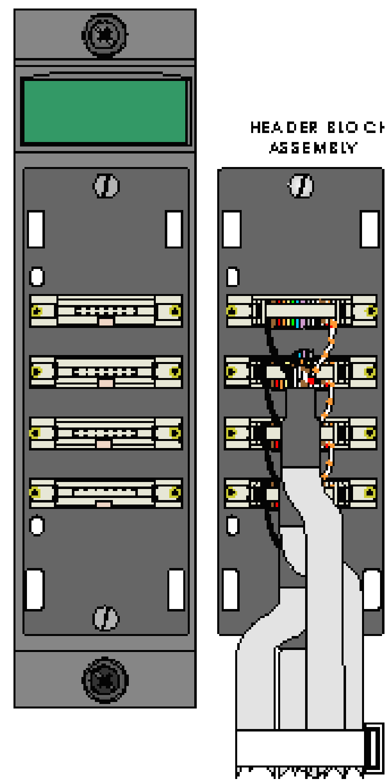
- Electrical Isolation: 1500 Vdc to system logic and 500Vdc to chassis
- Surge Suppression: 31 Vdc transorb across input and to field common
- Terminations: Pluggable, max wire size is 14 gauge. Set, reset, common and Shield terminals per input
- Status Indication: Status LED per input, module PASS/FAIL LED

Remote Termination Modules

The remote termination option for ControlWave Local I/O modules provides a convenient alternative to the standard direct connect termination. Remote terminiations allow a concentration of electrical connections from one or more controllers to be located in one area such as the rear of a 19" cabinet.

All Remote Termination modules are standard DIN-rail mountable and connect to the I/O module with from one to four pre-wired connector cables. To simplify installation, all I/O modules use the same cable.





Features

- Removes electrical connections from the controller
- Passive terminations are DIN-rail mountable
- Options for fusing, relays and 120 VAC I/O
- A single common connector cable for all I/O
- Up to 14 AWG wire with compression screw terminals

Available Modules

AI: 4 points, no fuses
AI: 4 points, with fuses
AO: 2 points, no fuses
AO: 2 points, with fuses
DI: 24 Vdc - 8 points, no fuses
DI: 24 Vdc - 8 points, with fuses
DI: 120 VAC - 8 points
DO: 24 Vdc - 8 points, no fuse
DO: 24 Vdc - 8 points, with fuse
DO: 8 points - 6 Amp relay

Cable Lengths

- 18 inch cable
- 39 inch cable
- 6-1/2 foot cable
- 13 foot cable

ControlWave I/O Expansion Rack

ControlWave I/O Expansion Racks allow for expansion of I/O up to and including total plant wide control consisting of hundreds of I/O points. The process control application program resides in the main ControlWave process controller. It controls both local I/O as well as the I/O in the Expansion Racks. No control functionality is required in the I/O Expansion Rack.

The ControlWave I/O Expansion Rack consists of a 2, 4, or 8 slot ControlWave Chassis. The chassis contains an Ethernet communication engine dedicated to communications between the main processor and the expansion I/O. The communication engine also supports timing functionality and battery backed RAM to retain outputs during short power outages. The ControlWave I/O Expansion Rack is connected to the main or host ControlWave controller rack via an Ethernet physical link using TCP/IP. Ethernet is widely accepted as a networking standard physical data link that allows the ControlWave I/O Expansion Rack to fit into any local or wide area Ethernet based network, thereby increasing flexibility and providing an economical, reliable, I/O system.

Hardware Features

- 10/100 Base T Ethernet Interface
- Serial communications ports for Ethernet port setup
- 2,4, or 8 I/O slot panel mounted stainless steel chassis, panel or 19' rack mount
- Supports all ControlWave I/O modules
- Hot swap I/O replacement
- Internal loop power for I/O simplifies installation
- AO's maintain last/preset value on CPU watch dog
- DO's maintain last or zero value on CPU watch dog
- Wide temperature range (-40 to +70 deg. C)
- Class 1, Div. 2 hazardous location and CE approval

Scalability

ControlWave I/O Expansion Racks allow for increased system flexibility depending on the process I/O count. The expansion racks provide a cost effective solution to large I/O count projects, and an economical approach to low or medium I/O count applications. ControlWave meets the needs of a wide range of applications.

Specifications

Communication Processor

- Data Memory: 2 MB SRAM battery backed memory
- 2-digit "Port 80" display for booting and run-time diagnostics

Communication

- Serial communication port with standard PC/AT 9-pin male D-sub connector, supporting baud rates up to 115.2 KB
- Isolation: RS-485 communication port isolated to 500 VDC
- One 10/100 Base T Ethernet port with RJ-45 connector. (This port is used as the main communication link to the Host controller.)
- Isolation: Ethernet port isolated to 500 VDC

Power Supply and Chassis

- 12 or 24 VDC power.
- Power-fail detection and recovery sequencer.
- System LED's for: Active, Fail, and Power OK.
- Power supply isolation: 500 VDC.
- ISA bus for I/O system (supports Hot Swap I/O) able to drive 8 chassis I/O modules
- Chassis dimensions are the same as for the ControlWave PAC

ControlWave Redundancy

Redundant systems are offered for critical processes and harsh applications that require maximum operational readiness and system availability. ControlWave Redundant Systems are designed to prevent a single point of failure from shutting down the system. ControlWave offers two levels of redundant operation in order to achieve the optimum level of reliability required by the application. Many applications require the level of reliability provided by the cost effective ControlWave Redundant Process Control and Communication system. Other, even more critical applications may require the higher system availability provided by the ControlWave Redundant I/O system. These designs deliver redundant systems that provide high availability, reliability, and safety.

ControlWave Redundant System

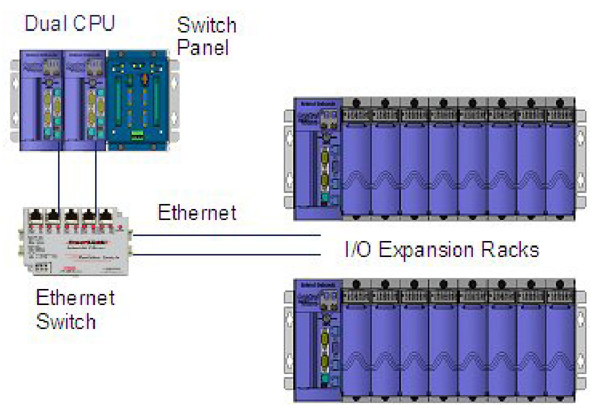
- Dual CPUs, Dual Power Supply Sequencers
- Automatic Failure Detection
- Automatic Switchover to Hot Standby Controller
- Switchover time typically < 500 ms
- High Reliability
- No Single Point of Failure
- Communication Channel Switching
- Alarm and Historical Data Backup
- No programming required for redundancy data transfer
- Upgrade programs on the fly
- Convenient Packaging

Refer to product data document 420ds11a.pdf for complete details.

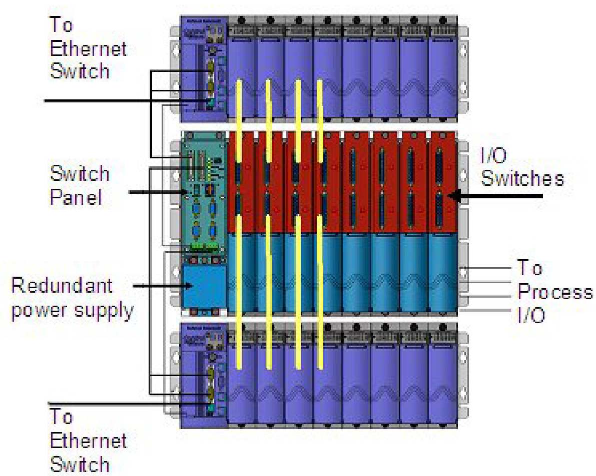
OpenBSI

Simply Creative

Emerson's OpenBSI (Open Bristol System Interface) is a set of network setup, communication diagnostic, and data viewing utilities that provide access to both



Process Control and Communications Redundancy



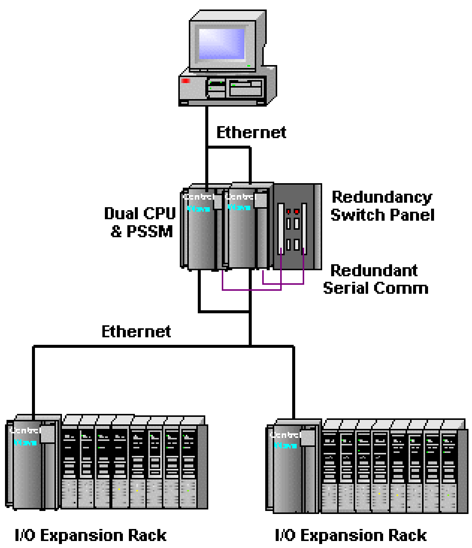
Local I/O or Expansion I/O Redundancy

ControlWave and Network 3000 controllers and RTUs. OpenBSI is the only product available in the industry to bring such unique functionality and ease of use to the network level. At the core is the communication interface, written as a Windows communication server API through which other client applications communicate with Emerson networks.

OpenBSI supports both serial BSAP protocol and Ethernet Internet Protocol communication to ControlWave and Network 3000 RTUs and controllers.

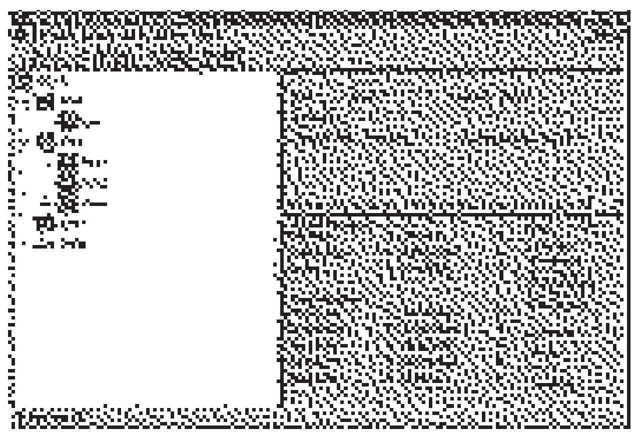
OpenBSI Utilities

Above this communication layer are a group of applications known as OpenBSI Utilities. These client utilities communicate through the server to collect and manage data gathered from the network, generate files based on collected historical data, collect alarms, and monitor and control OpenBSI communications.



- Communication engine for PC applications
- Supports ControlWave and Network 3000 serial and IP protocols
- RS 232, Dial-line, cellular, radio, CDPD, satellite, and Ethernet connections
- Provides on-line download & signal variable changes
- Allows network configuration through NetView
- PC and Network communication diagnostics
- OPC Server for interfacing to most HMI software
- Harvester collects historical data on request or scheduled basis

NetView is the basic configuration and application interface for all network operations. NetView uses a tree structure for network graphical display in the Windows Explorer style. Network nodes can be added on-line by simply dragging the node icon into the tree. This invokes a configuration Wizard, simplifying network setup. Through the NetView Wizard, the necessary network parameters are entered for node and IP address, alarm and message routing, and network communication media. Once configured, selecting any node allows direct access to the common OpenBSI utilities to reprogram, download a new application to the node, review communication statistics, view real-time data through DataViewer, and edit controller/RTU properties.



NetView - Network configuration and application LaunchPad

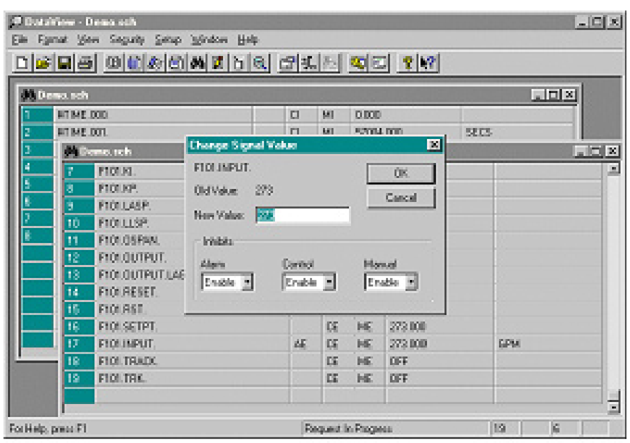
Local Configuration Wizard allows local communication with any attached ControlWave controller or RTU to download system flashware upgrades, configure cold download parameters, and configure IP and soft-switch parameters.



Configuration Wizard simplifies network setup

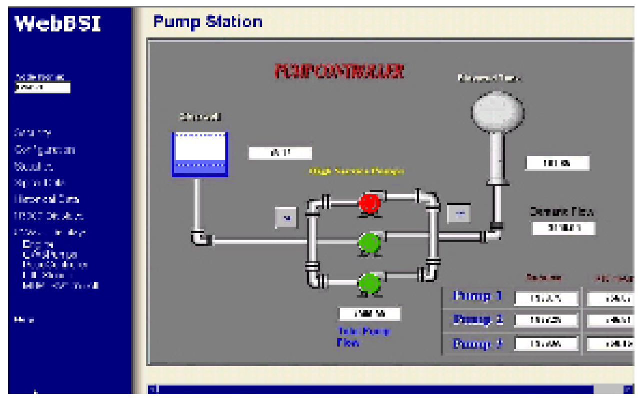
DataView is an on-line utility used to collect and display several types of process data, including signal values, data array values, signal lists, and audit trail information.

Operators have the ability to alter signal values. Multiple DataView windows may be open simultaneously.



DataView for Real-time data display

WebBSI - WebBSI is a powerful and flexible software product bringing web technology to all of Emerson's Bristol automation and SCADA products. WebBSI includes a set of ActiveX Controls for reading and writing real-time and historical data, trending, recipe editing and custom display generation. Through these controls, you can use the standard Microsoft Internet Explorer web browser to access Network 3000, TeleFlow and ControlWave products through a set of supplied HTML web pages.



Custom built web page interface using a standard web browser

Real-time ActiveX Controls

One of the many benefits OpenBSI brings to you is our use of open standards such as ActiveX Controls. ActiveX is another of the Microsoft standards, which allow plug and play with any ActiveX container, using Microsoft ActiveX container technology such as Visual Basic, HTML web pages, and Microsoft Excel.

The set of available ActiveX Controls provides the basic functions necessary to communicate and collect data from ControlWave.

ActiveX Controls

- Security 0 56-bit encryption - allows the user to sign on to the RTU
- Signal Value - displays signal values in various formats

- Comm Statistics - works with a standard page that displays the RTU's communication statistics
- Configuration Info - works with a standard page that displays and allows the user to change RTU configuration information
- Historical - Collect and view historical archive and audit files

The IP compliant ControlWave opens the door for owner controlled access via web pages. Any generic web page builder can be employed to create user defined pages to access ControlWave. The web pages are populated with these pre-configured ActiveX controls.

Required Software

Microsoft Internet Explorer

Bristol ActiveX Controls

OpenBSI LocalView or NetView

Historical Data Collection

Historical Data Collection

High Historical Data Integrity

The ControlWave Historical Data Collection system offers exceptional historical data integrity by providing time-stamped historical data storage in ControlWave flash memory. The historical data is collected, through OpenBSI, on a scheduled or demand basis and converted to .CSV and ODBC compliant file formats for use in spreadsheets and reports. If data is missed due to a communication failure, it is collected when the communications is re-established and the PC historical database is backfilled with the missing data. This distributed historical database architecture provides the greatest data reliability and integrity during communication or PC failuer.

Another important historical feature is the Audit storage and collection system. The Audit Trail is a files stored in ControlWave flash memory containing significant events and time-stamped alarms. The alarms stored in the Audit system provide a historical archive in addition to the real-time alarm reporting system.

This file is also collected through OpenBSI and presented as a text file in the PC. This functionality is extremely useful in providing an event trail during communication or PC downtime or other sytem problem.

- Archive collection - collection and storage to disk of the ControlWave archive data
- Audit collection - collection and storage to disk of the ControlWave audit data
- Exports data files to third party, .CSV & ODBC applications
- DDE compliant for use with other popular Windows applications

OPC Server

With industry demand for open standards, ControlWave answers the call by embracing technologies that open the door for maximizing your efficiency and productivity. The OPC standard was developed by the OPC Foundation comprised of hardware and software suppliers from the process control community. OPC allows the engineer to select best in class hardware and software with confidence in their interoperability. Our OpenBSI OPC Server was among the first to comply with the OPC Foundation alarm and event server specification.

- OPC Data Access 1.0a & 2.0 compatible
- Windows, 2000 & XP
- Compatible with both ControlWave and Network 3000 systems
- 32 bit multi-threading, multi-processor design
- Automatic database reader
- Integrated real-time data monitor
- Supports OPC Browser interface
- Supports both serial comm and IP Ethernet connections
- Supports COM/DCOM & OLE Automation

- Primary and Background polling scheme
- OPC Alarm & Event Server support

ControlWave Open Network Connectivity

By embracing the open system network technologies available through TCP/IP, Ethernet, OPC, and Microsoft DNA, as well as pseudo standards such as Modbus and Open Modbus, ControlWave can provide a total Process Automation Management Solution for in-plant LAN based networks and WIde Area Network SCADA systems.

With the exceptional connectivity provided by the ControlWave network, access to real-time data and operating conditions, historical data, maintenance and performance data are all available to the global network. ControlWave provides the needed information to the plant floor technician, operator, engineer, supervisor and corporate management, even external customers.

Communication Protocols

Like all of Emerson's products, Bristol ControlWave supports BSAP (Bristol Standard Asynchronous Protocol), Modbus, DFI, CIP, DNP3 and serial ASCII as standard functions. These protocols are implemented in Flashware so no additional hardware is required to use any one or a combination of all protocols.

BSAP Protocol

All Emerson's Bristol Network 3000 and ControlWave RTU and controller products support BSAP protocol. BSAP is widely accepted as providing exceptional data integrity and greatly simplifies communication between controllers. BSAP is provided with interfaces for Master/Slave, vertical networks, and Client/Server, horizontal networks. In either case, variable lists are created in each controller that are easily passed from server to client or slave to master.

BSAP meets the definition of an industry-standard, open architecture protocol because it conforms to ISO standards 2629, 1745 and 2111, it is not proprietary in that Emerson does not charge a license fee and makes the protocol and documentation available to anyone.

While BSAP is an open protocol, the added functionality of the messages provide much more capability than is found in other networks.

- Global time-synchronization
- Time-stamped Alarm reporting
- Historical archive data transfer
- Audit file transfer
- On-line program editing
- Diagnostics
- Communication statistics

Modbus Protocol

Modbus - Modbus is often considered a de-facto standard protocol because of its broad usage as either the primary or a secondary offering in many measurement and control related products. Even with its common use, Modbus protocol actually has many variations. Consider Modbus RTU and Modbus ASCII, Master & Slave, Serial and TCP/IP Open Modbus. In addition, there are considerations regarding supported function codes, floating point values and byte order. ControlWave supports the following:

- Modbus serial and TCP/IP Open Modbus (Ethernet)
- Master and slave
- Modbus RTU and ASCII
- Modes 1 - 7, 8, 15 & 16
- IP modes 51, 52, & 53
- Integer and IEEE 4 byte floating point

Generic Serial Interface

The Generic Serial Interface is a user programmable Master and Slave protocol used to send and receive messages typically with third party serial ASCII devices. This protocol can be used to interface with such devices as message boards, card readers and many measurement devices.

Key-Lock Security

The front panel keyswitch on ControlWave provides a high level of manual security by allowing three modes of operation to restrict access ot on-line functions.

In *Run Mode*, ControlWave will reject any attempt to download or modify the running program, either locally or over the network.

In *Remote Mode*, ControlWave will allow downloading and on-line program modification through the network provided the security access requirements have been met. Local download and on-line modification of the running program is prohibited.

In Local Mode, ControlWave will allow download and on-line modification through either the network connection or through a local serial communication port provided the security access requirements have been met.

Multi-User Security Access

Security is an essential element of any open system, particularly those with Internet access. ControlWave employs a User Name/Password access system protected by a 56-bit encryption technique through the TCP connection. There can be up to thirty-two users who sign in using their name and password. Both the name and the password can be up to sixteen characters.

The security system provides for up to sixty-four access rights to read and write data values and files via FTP, access and configure historical and audit data information, edit configuration, run internal diagnostics, read and reset system status. It further allows the programming software to read, write and download the ControlWave.

The Secure Data Advantage

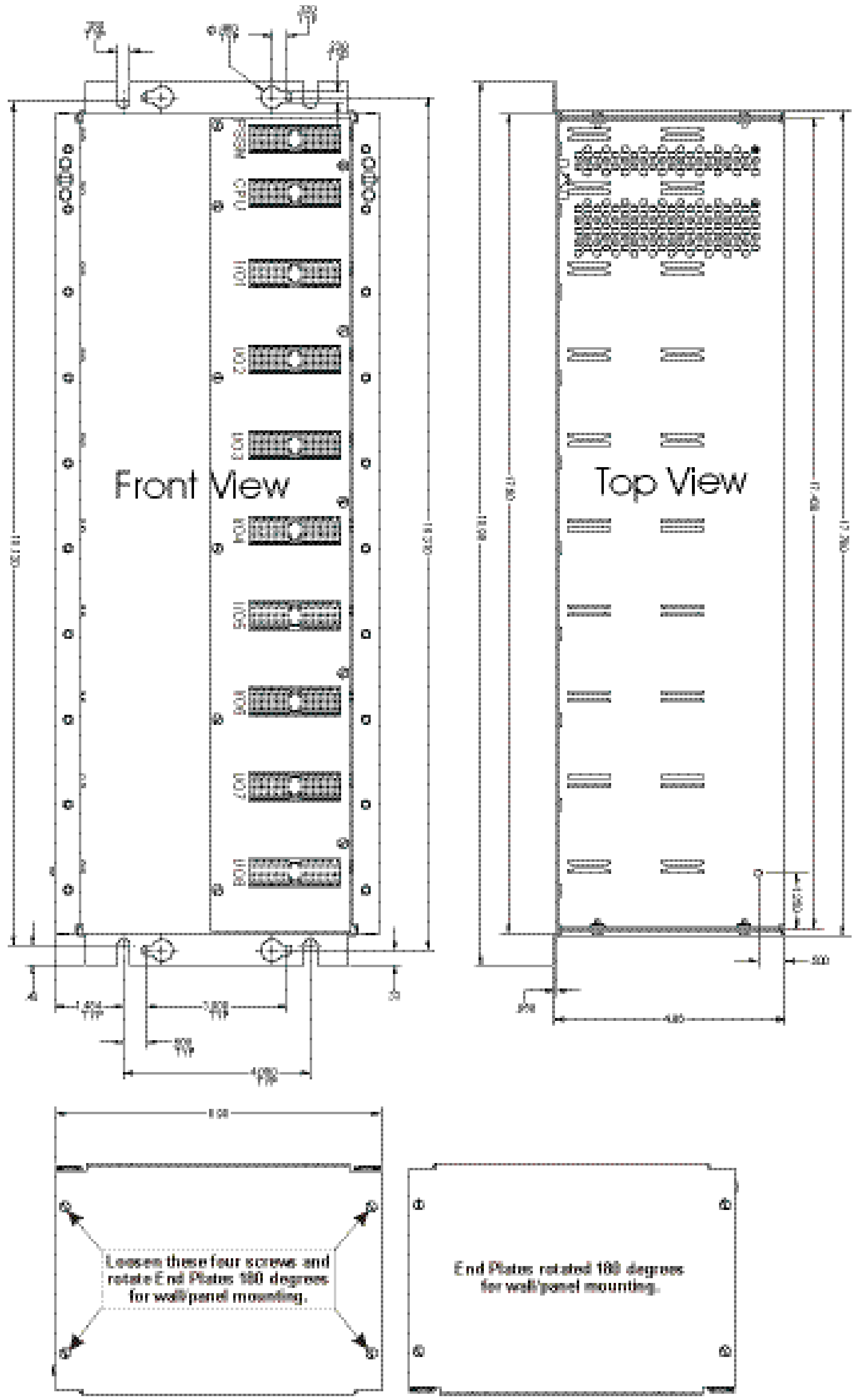
ControlWave sets a new standard for providing intelligent control at the point where control is needed. Whether you need control on the plant floor or at a remte site in the "middle of nowhere", ControlWave is the solution for control, communication and secure data to help you make the right operating decisions.

ControlWave was designed to provide the optimum level of data security using a distributed database architecture. All data including time & date stamped alarms, alarm limits, and historical data are stored locally in each industrially rugged ControlWave, thereby distributing your data integrity risk. To firther ensure that the data is always current and historically accurate, the historical data is stored in non-volatile flash memory within ControlWave. Historical data is even maintained during and after program downloading.

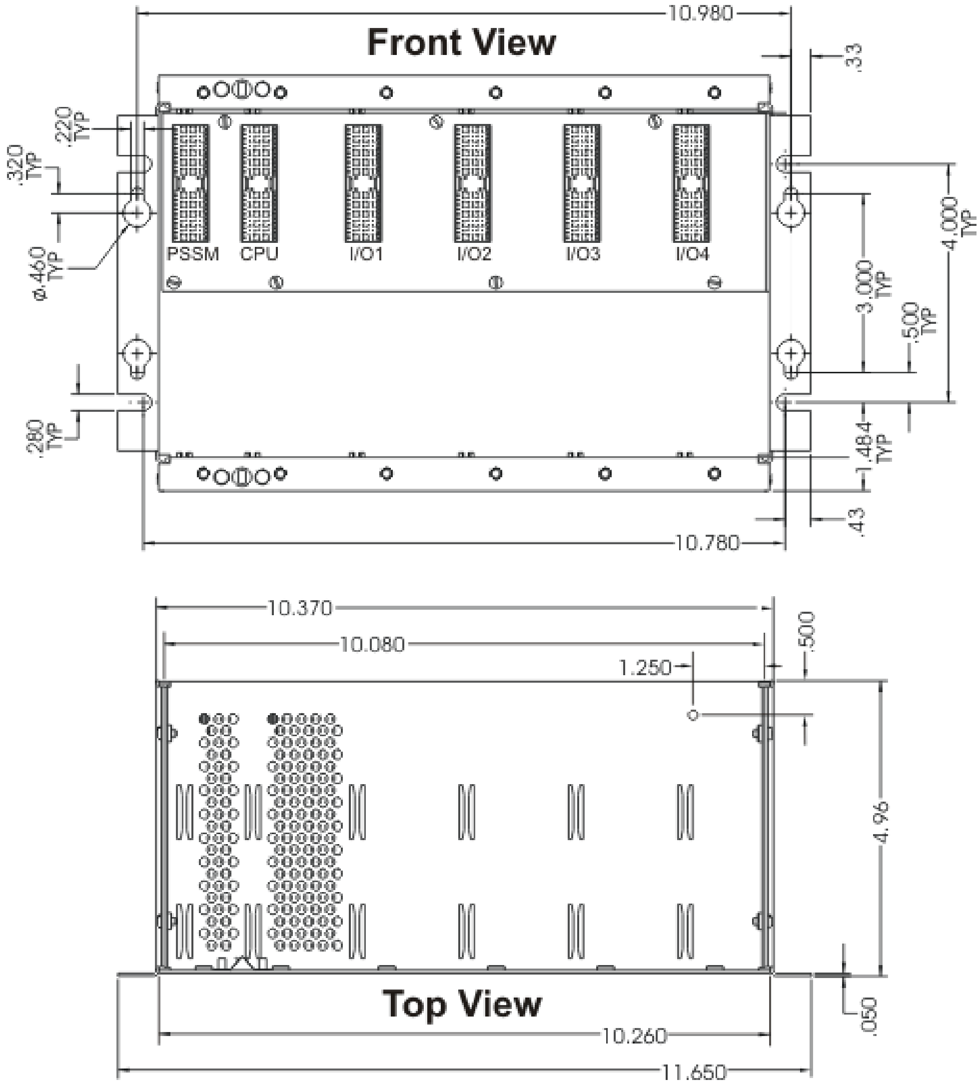
When historical data is collected from ControlWave, it is converted and appended to .CSV and/or ODBC compliant databases but does not destroy the original historical data stored in ControlWave, thus providing a flexible and secure historical data system that is clearly recognized as a benefit to virtually every industrial application.

The Bridge Between Systems

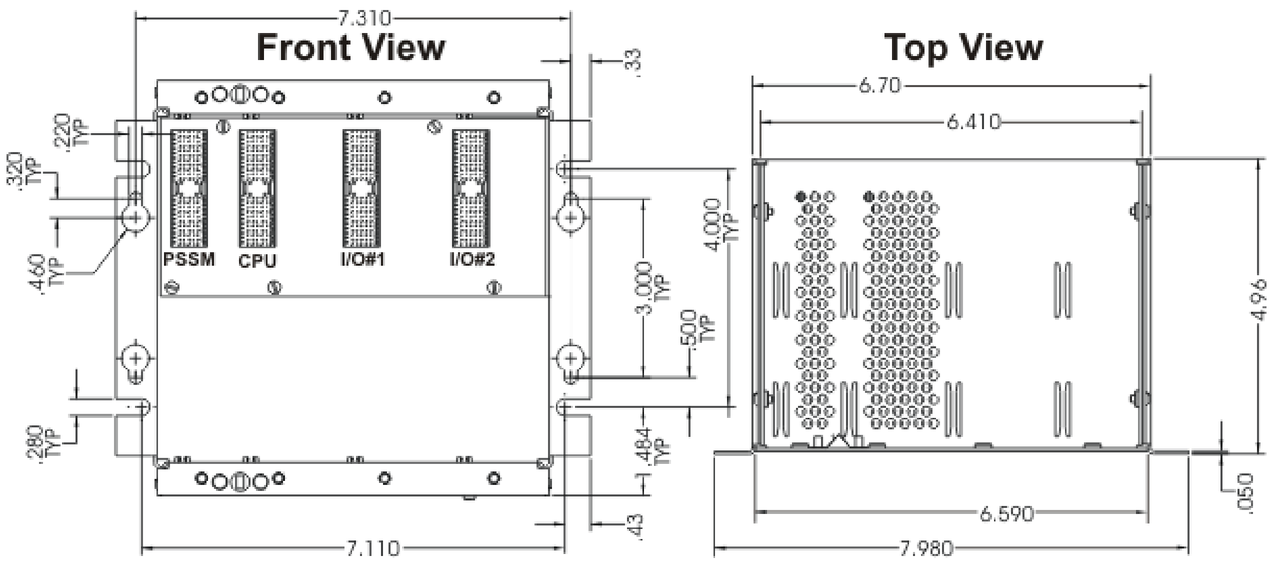
Continuing our tradition of introducing innovative new solutions while maintaining compatibility with existing systems, Emerson again provides a migration path for existing customers by bridging the new ControlWave system with Network 3000 systems already in place. The network bridge is enabled by employing the open architecture technologies afforded by TCP/IP and OPC in both networks. TCP/IP allows seamless Ethernet connectivity to both networks as well as the corporate Intranet so both ControlWave and Network 3000 controllers can reside and communicate on the same LAN. Emerson's Bristol OpenBSI OPC Server facilitates the merging of the two networks for technical, engineering and operator data access. The data source, configuration and path are completely transparent to the OPC client. Real-time data can also be passed between the two communication networks, making this a total Plant Automation Management Solution.



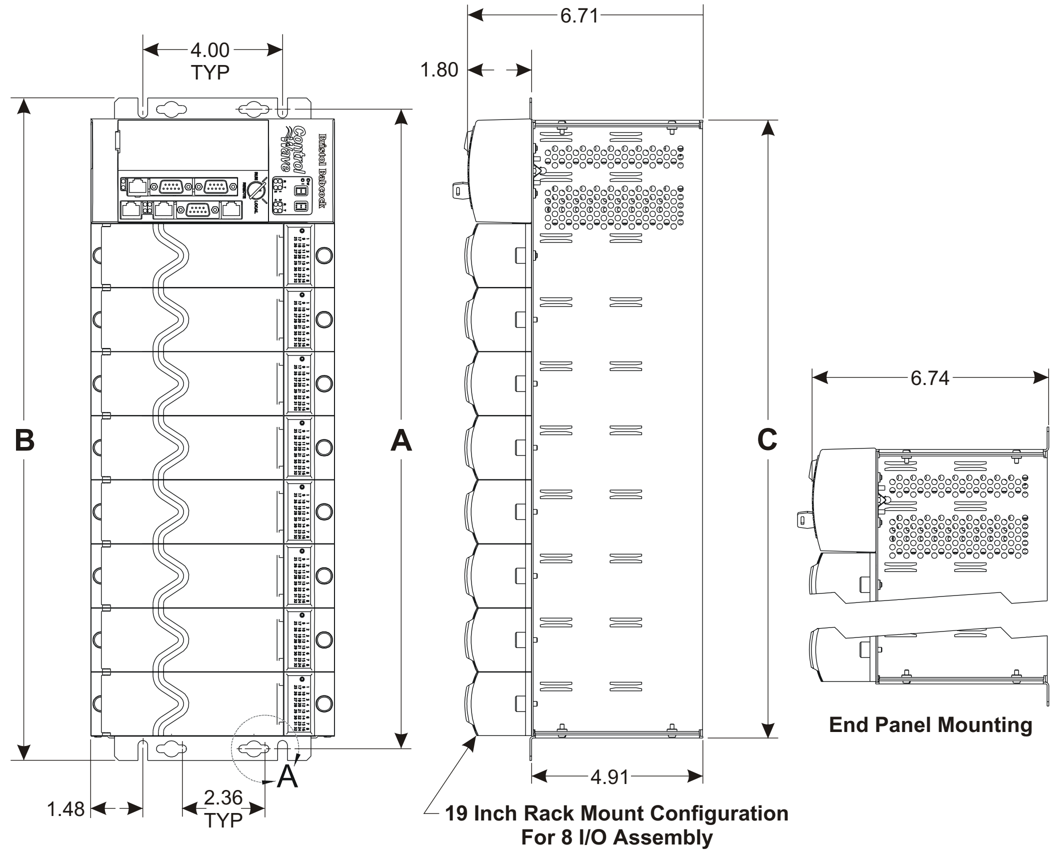
8-I/O Module - ControlWave - Mounting Dimensions

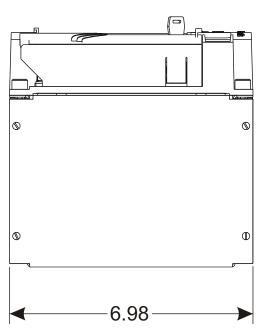


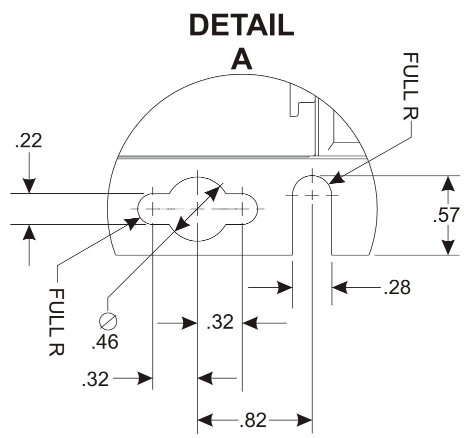
4-I/O Module - ControlWave - Mounting Dimensions



2-I/O Module - ControlWave - Mounting Dimensions







ASSEMBLY	DIM. A	DIM. B	DIM. C
8 I/O Modules	18.31	18.98	17.70
4 I/O Modules	10.98	11.65	10.37
2 I/O Modules	7.31	7.98	6.70

All Dimensions Are In Inches

ControlWave Installation Drawing

ControlWave Base Unit

DESCRIPTION		PART NO.
ControlWave **main and I/O Expansion rack Chassis (Holds PSSM, CPU and 2, 4, or 8 I/O modules) Select either the** ControlWave **CPU or I/O Expansion rack CPU.**		
0 I/O slot chassis	Panel mount	396463-01-0
2 I/O slot chassis	Panel mount or 19” rackmount	396356-03-6
4 I/O slot chassis	Panel mount or 19” rackmount	396356-02-8
8 I/O slot chassis	Panel mount or 19” rackmount	396356-01-0
Internal Power Supply Sequencer Module (PSSM)		
12 V input power	PSSM	396351-02-6
24 V input power	PSSM	396351-01-8
Redundant I/O System PSSM		
24 V input power	PSSM used with Redundant I/O system. See Page 5	396351-03-4
CPU (See Note 1)	**Comm Port Configurations (Note 3)**	
CPU with 16 MB of RAM	1 - ENET & 2 - RS 232	396359-01-9
CPU with 16 MB of RAM	1 - ENET & 3 - RS 232 & 1 - RS 485 (Note 2)	396359-06-0
CPU with 16 MB of RAM	1 - ENET & 2 - RS 232 & 2 - RS 485 (Note 2)	396359-07-8
CPU with 16 MB of RAM	3 - ENET & 3 - RS 232 & 1 - RS 485 (Note 2)	396359-05-1
CPU with 16 MB of RAM	3 - ENET & 2 - RS 232 & 2 - RS 485 (Note 2)	396359-12-4
I/O Expansion Rack CPU	**Comm Port Configurations (Note 3)**	
Comm CPU	2 - RS232 & 1 - ENET	396458-01-7
Comm CPU	1 RS 232, 1 - RS 485 & 1 - ENET	396458-02-5

ControlWave Base Unit (Continued)

DESCRIPTION		PART NO.
Local Termination I/O Modules		
16 AI	4-20 mA Internally or Externally powered AI	396352-01-4
16 AI	1-5 V & ext. powered 4-20 (with 250 ohm on input)	396352-02-2
8 AI	4-20 mA Internally or Externally powered AI	396352-03-0
8 AI	1-5 V & ext. powered 4-20 (with 250 ohm on input)	396352-04-9
6 TC	B, R, S, J, E, K, T, C, N, + 10 mV	396877-01-0
4 RTD	2, 3, or 4 wire platinum RTD	396878-01-6
8 AO	4-20 mA	396353-01-0
8 AO	1-5 V	396353-02-9
4 AO	4-20 mA	396353-03-7
32 DI	Selectable Internally or Externally powered Dry Contact	396357-01-6
16 DI	Selectable Internally or Externally powered Dry Contact	396357-02-4
32 DO	Open Drain - 500 mA current capability, 30 mS filter	396358-01-2
16 DO	Open Drain - 500 mA current capability, 30 mS filter	396358-02-0
12 UDI (HighSpeed Counter)	Both 12 and 6 UDI High speed counters come with selectable	396362-01-0
6 UDI (HighSpeed Counter)	debounce (enabled/disable) @ (0-10 KHz) Low or High speed	396362-02-8
Notes		
Note 1: CE approval requires the CE Accessories kits.		
Note 2: RS485 Comm port 3 is RJ45. RS 485 ports have 500 V isolation		
Note 3: The I/O Expansion Rack CPU interfaces to the main ControlWave Chassis CPU via Ethernet		
Note 4: For conformal coating add -C suffix to each part number.		

ControlWave I/O Modules and Termination Blocks

DESCRIPTION		PART NO.
Remote Termination I/O Modules (PC 850)		
16 AI	4-20 mA Internally or Externally powered AI	396352-11-1
16 AI	1-5 V & ext. powered 4-20 (with 250 ohm on input)	396352-12-0
8 AI	4-20 mA Internally or Externally powered AI	396352-13-8
8 AI	1-5 V & ext. powered 4-20 (with 250 ohm on input)	396352-14-6
6 TC	B, R, S, J, E, K, T, C, N, + 10 mV	396877-02-8
4 RTD	2, 3, or 4 wire platinum RTD	396878-02-4
8 AO	4-20 mA	396353-11-8
8 AO	1-5 V	396353-12-6
4 AO	4-20 mA	396353-13-4
32 DI	Selectable Internally or Externally powered Dry Contact	396357-11-3
16 DI	Selectable Internally or Externally powered Dry Contact	396357-12-1
32 DO	Open Drain - 500 mA current capability, 30 mS filter	396358-11-0
16 DO	Open Drain - 500 mA current capability, 30 mS filter	396358-12-8
12 UDI (High Speed Counter)	Both 12 and 6 UDI High speed counters come with selectable	396362-11-7
6 UDI (High Speed Counter)	debounce (enabled/disable) @ (0-10 KHz) Low or High speed counters. Inputs are 24VDC only.	396362-12-5
Remote Terminal Blocks - (replacement fuses & relays can be found on spares page) (PC 851)		
4 point AI **(Note 1)**	No fuse	396391-01-0
4 point AI	Fused	396391-02-8
2 point AO **(Note 1)**	No fuse	396391-01-0
2 point AO	Fused	396391-02-8
8 point DI	No fuse	396292-01-6
8 point DI	Fused	395622-02-6
8 point DI - 120 Vac	No fuse (for internally powered DI module)	395622-04-2
8 point DI - 120 Vac	No fuse (for externally powered DI module)	395622-01-8
8 point DO	No fuse	396292-01-6
8 point DO	Fused	395622-03-4
8 point DO	6 Amp Relay - No fuse	395622-00-0
3 point UDI	No fuse	396391-01-0
3 point UDI **(Note 2)**	No fuse protection	396391-02-8

ControlWave I/O Modules and Termination Blocks (Cont'd)

DESCRIPTION		PART NO.
Remote Terminal Blocks (one cable required for each terminal block) (PC 851)		
39" Term Cable		396389-01-5
6.5 ft." Term Cable		396389-02-3
13 ft. Term Cable		396389-03-1
Note 1: Sheild termination connection for AI & AO Remote Terminal blocks recommend (P/N 395722-01-2) AO requires one and the AI requires two. Note 2: Fuses do not offer protection for UDI points.		395722-01-2

ControlWave Redundancy

CWREDCPU - A - BC - D

CODE	DESCRIPTION	CWREDCPU	CODE
Redundant unit includes: Chassis, 2-PSSM, 2-CPU, Redundancy Switch Panel and serial communication cables from the CPUs to the Switch Panel. I/O is located in the Expansion Rack			
A	**Internal Power Supply Sequencer Module**		**A**
10	PSSM	Power Supply +24 VDC input power	1
	PSSM	Power Supply +12 VDC input power	2
BC	**Dual Redundant CPUs**	**Comm Port Configurations CWREDCPUCP**	**BC**
20	CPU	(2) RS 232, (1) ETHERNET	01
	CPU	(2) RS 232, (2) RS-485, (1) ETHERNET	07
	CPU	(2) RS 232, (2) RS-485, (3) ETHERNET	12
D	**Chassis & Switcher Assembly**	**CWREDCHASI**	**D**
30	With Cables, Panel Mount	(2) RS-232, (2) RS-485	2

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